RELATIONSHIPS AND TAXONOMIC PLACEMENT OF THE GENUS *BLACUS* (HYMENOPTERA: BRACONIDAE)

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The genus *Blacus* Nees von Esenbeck, 1818, is one of the large Braconid genera, not only by the number of known species (Haeselbarth 1973 lists 43 species from Europe and Central Asia in his revision) but also by the abundance of some of them. They are often observed swarming in large numbers like the Chironomidae. Information on their host relations, biology, and developmental stages is contradictory or scanty. The classification of the genus is chiefly based on external morphology of the adults. Consequently there are often disagreeing opinions on the relationships of the genus and its position in the Braconid hierarchy.

HOST RELATIONS OF BLACUS SPECIES

There are several references on the hosts of *Blacus* species, but most of them are unreliable. The first report of Bouché (1834) refers to *Lacanobia oleracea* as the host of *Blacus humilis*. This is almost certainly erroneous, and probably pertains to an *Apanteles* sp. The fore wing venation of *Apanteles* resembles to a certain extent that of *Blacus*. All other records of lepidopteran hosts are also unlikely, like *Mamestra brassicae* for *B. humilis* (Rondani, 1876), *Tortrix* sp. and *Bucculatrix nigricomella* for *B. maculipes* (de Gaulle, 1907), *Simyra albovenosa* for *B. sp.* (Cole, 1931), *Tortrix viridiana* and *Rhyacionia buoliana* for *B. sp.* (Kolubajiv, 1962a), *Coleophora conspicuella* for *B. sp.* (Kolubajiv, 1962b), and *Thaumetópoea pityocampa* for *B. instabilis* (Anonymous, 1963). There is little doubt that three records of Hymenoptera and one of Aphidoidea as the hosts of *Blacus* species are also incorrect: *Nematus* sp. for *B. errans* (Rudow, 1918), *Megastigmus brevicaudis* for *B. exilis* (Ahlberg, 1927), *Spilomena troglodytes* for *B. longipennis* (Schutze et Roman, 1931), and *Phorodon cannabis* for *B. ruficornis* (Goidanich, 1928).

Several dipteran hosts also appear in the literature for *Blacus* species. Goureau (1851) reported *Agromyza nana* as the host of *B. ruficornis* and from the same host he described *B. florus* Rondani (1876) described *B. brachialis* from *Chlorops lineatus*. Further dipterous host records are *Fungivora signata* as the host of *B. maculipes* (Fahringer, 1922), *Philophylla heraclei* for *B. exilis* (Lundblad et Lindblom, 1925), and *Rhabdophaga saliciperda* for *B. errans* (Telenga, 1935). These host species develop in plant tissues (galls, mines, fungi, etc.) where other insects often live. This increases the probability of associating *Blacus* species with incorrect hosts, especially in mass rearings. The most recent host records are of *Oscinella frit* for *B. interstitialis* (Fischer, 1963), *Contarinia medicaginis* for *B. instabilis* (Anonymous, 1963), *Acanthiophilus helianthi* for *B. ? impudians* (Fulmek, 1968), and *Contarinia medicaginis* for *B. exilis* (Haeselbarth, 1973).

The coleopterous hosts of *Blacus* species are mentioned in the literature most often and seem to be the most reliable, although there are obviously some mistakes. Boudier (1834), described *B. barynoti* from *Barynotus elevatus*

Ratzeburg (1848) mentioned *Stereonychus fraxini* as the host of *B. hastatus*. Ruthe (1861) recorded *Scolytus mali*, *S. rugulosus*, *Stenostola nigripes*, *Tetrops praeusta*, *Pogonochaerus hispidus*, and *Dasytes plumbeus*, as possible hosts of *B. errans*. Goureau (1862) described *B. fuscipes* from *Scolytus rugulosus*. Further references are found in the host-parasite catalogues or parasite lists of the following authors: de Gaulle (1907) mentioned *Barynotus obscurus* and *Otiorrhynchus ligneus* as hosts of *B. barynoti*, de Gaulle (1908) *Exocentrus adspersus* for *B. errans* and *Barynotus obscurus* for *B. pallipes*, Wahl (1914) *Anisandrus dispar* and *Xyleborinus saxeseni* for *B. fuscipes*, Feytaud (1914) *Otiorrhynchus* spp. for *B. pallipes*, Rudow (1918) *Barynotus* sp. and *Miarus campanulae* for *B. armatulus*, and *B. humilis*, *Otiorrhynchus* sp., and *Barynotus* sp. for *B. barynoti*, *Gymnetron* sp. and *Orchestes* sp. for *B. conformis*, *Liophloeus schmidti* for *B. diversicornis*, *Ceutorrhynchus* sp. and *Apoderus coryli* for *B. maculipes*, *Curculio glandium* for *B. tripudians*, and *Cionus thapsi* for *B. humilis* Ns., Schutze et Roman (1931) *Dasytes coeruleus* for *Blacus* sp., Telenga (1935) *Cryptocephalus lycoperdi* for *B. humilis*, Morley (1937) *Cis* sp. for *B. hastatus*, Thompson (1953) *Otiorrhynchus rhynchus laevigatus* for *B. barynoti*, and *Pityogenes chalcographus* for *B. fuscipes*, Wayman (1957) *Cryptophagus subfumatus* for *B. instabilis*, Jourdheuil (1960) *Meligethes aeneus* for *B. hastatus*, Kolubajiv (1962a) *Magdalis violacea*, *Pissodes harcyniae*, *Dendroctonus micans*, and *Ernobius pini* for *Blacus* sp., Lipkow (1965) *Tachyporus obtusus* for *B. ruficornis*, and Alford (1975) *Antherophagus* sp. from bumblebee nests for *B. paganus*.

The more reliable records are of Fischer (1962) of *B. koenigi* from *Scolytus koenigi*. Valuable data on host associations are in Haeselbarth's revision of the genus: *Ceutorrhynchus* sp. and *Meligethes aeneus* for *B. nigricornis*, *Magdalis armigere* and *Pityokteines vorontzowi* for *B. exilis*, *Dryocoetes autographus*, *Abdera flexuosa*, and *Triplax russica* for *B. hastatus*, *Blastophagus piniperda* and *Sitodrepa panicea* for *B. humilis*, and *Cryptophagus* sp. and *Carpophilus* sp. for *B. instabilis*. A total of 46 species of Coleoptera (Curculionidae 17, Ipidae 10, Cerambycidae 5, Nitidulidae and Cryptophagidae 3, Cantharidae and Anobiidae 2, and Erotylidae, Cisidae, Melandryidae, and Staphylinidae 1 species) are mentioned in the liaterature as the hosts of various *Blacus* species.

Among the Braconids that I have received from many entomologists during the past 25 years for naming, there were only two specimens of *Blacus* reared from the known hosts. The first was *B. errans* Ns. reared by Professor Capecki of Cracow, Poland from *Dasytes* sp., while the second was *B. longipennis* Grav. reared by Dr. Kinelski of Warsaw, Poland from *Anaspis* sp.

The species of *Blacus* seem to have specialized as the parasites of the Coleoptera and less probably of the Diptera. The host records from other insect orders are evidently erroneous, and are misidentifications, either of the hosts or the parasites.

BIOLOGY OF BLACUS SPECIES

There is even less reliable information available on the biology of *Blacus* species. Bouche (1834) stated that *B. humilis* Ns. was a gregarious endoparasite in the larvae of *Lacanobia oleracea* and pupated in a loose heap of greyish cocoons in the host pupal cell in the soil. This report seems to be rather doubtful and most probably it relates actually to an *Apanteles* species. Several authors further recorded *Blacus* species as internal parasites of the host larvae. Only Lipkow (1965) *B. ruficornis* as an internal parasite of the host adult and Rondani (1876) as an internal parasite of the host pupa. Although Stich (1929) stated that *Blacus* species are parasites of the adult Coleoptera, the published evidences indicate that they are larval parasites. This is confirmed by my observations that the remains of the coleopterous larvae were attached to the cocoons from which *B. errans* and *B. longipennis* emerged.

The dancing or swarming habit of several *Blacus* species has been long known. More recently Haeselbarth (1973) refers to the swarming of *B. maculipes*, *B. nigricornis*, and *B. longipennis*. Most authors observed only males in the swarms, but Smits van Burget (1921) observed both sexes of *B. ruficornis*. The swarming represents the nuptial flight (konig, 1964; Tobias, 1965; and Gruhl, 1967). *Blacus* spp. are often captured by the light traps. The nocturnal activity is typical for them (Tobias, 1965; Haeselbarth, 1973; personal observation).

The number of generations of *B. hastatus* was studied by Jourdheuil (1960) and of *B. ruficornis* by Konig (1967). Both species are bivoltine or polyvoltine. Smits van Burgst (1921) and Hancock (1925) observed that only the females of *B. ruficornis* overwinters.

It therefore appears that the species of *Blacus* are solitary endoparasites of the host larvae. Most of them are nocturnal and swarming congregation of the males is typical.

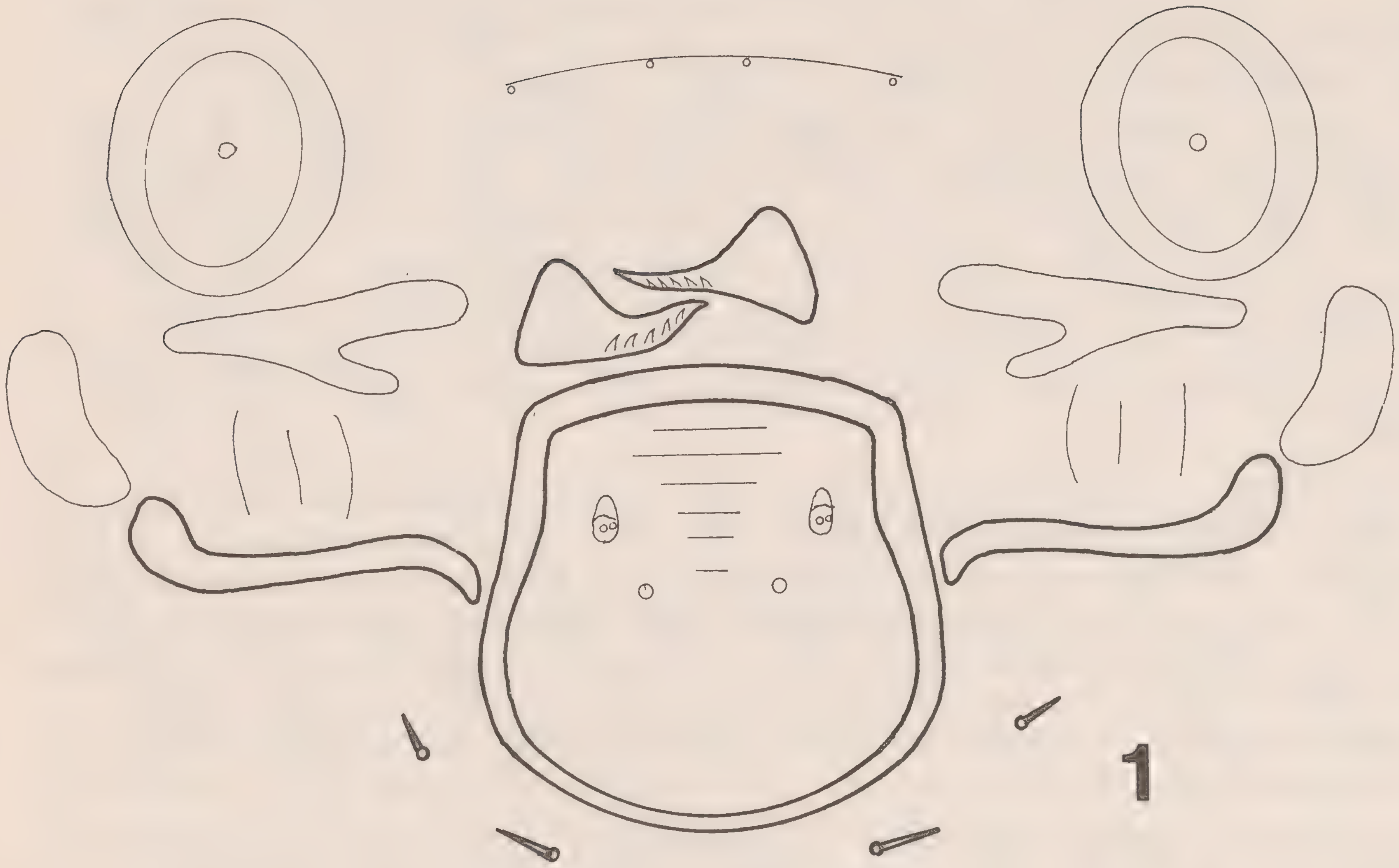
TAXONOMY OF LAST INSTAR LARVAE OF BLACUS SPECIES

Up to present time only the larva of *B. longipennis* (as *Blacus* sp. in Čapek, 1970) was described and figures (Fig. 1). Now the last instar larval cast skin of *B. errans* has been studied. (Fig. 2). On the base of these two species the larvae of *Blacus* spp. can be characterized as follows: mandibule with more or less distinct base, the blades with two rows of 4-5 teeth; labial sclerite almost rectangular, basically round; labial palpi with one large sensillum and 1-2 small sensilla; stipital sclerite and cardo distinct; hypostoma rudimentary, hypostomal spur indicated as well as epistoma; antenna disc-shaped, with visible sensilla; spiracle with cup-shaped atrium, which is about three times as wide as the closing apparatus; skin with two types of spines--most spines are of about one sixth of mandible length, a few longer spines are about half as long as mandible.

The generalized form of most head sclerites in the larvae of *Blacus* species resemble the Braconid genera like *Eubazus*, *Triaspis*, *Aliolus* and *Allodorus*.

RELATIONSHIPS OF BLACUS TO OTHER BRACONID GENERA

Blacus was originally placed between *Microgaster* and *Rogas* (= *Macrocentrus*) by Nees von Esenbeck (1818) Other authors placed it variously, as:



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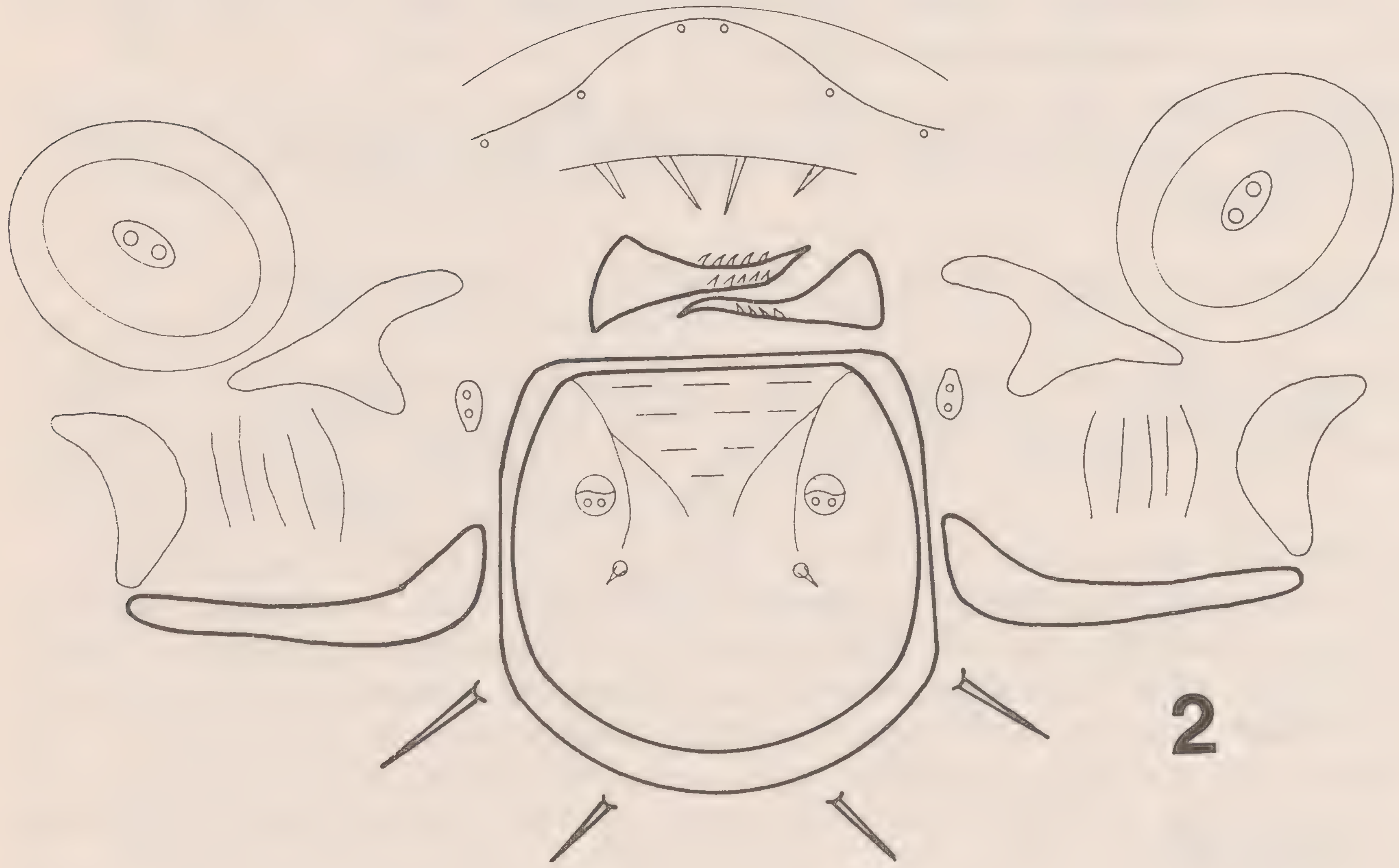

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Figs. 1–2. Head sclerites of the last instar larva of : 1, **Blacus longipennis** Gravenhorst. 2, **Blacus errans** Nees.

Haliday (1835) between *Perilitus* and *Helcon*, Wesmael (1835) between *Hybrizon* and *Leiophron*, and Ratzeburg (1852) between *Pleiomerus* and *Eubadizon*. Foerster (1862), Marshall (1889), Dalla Torre (1898), Schmiedeknecht (1930), Watanabe (1937), and Docavo Alberti (1960) placed Blacoidae between Brachistoidae and Liophronoidae, Ashmead (1900) between Helconinae and Sigalphinae, Szépligeti (1904) and Viereck (1918) between Liophroninae and Ichneutinae, Granger (1949) between Meteorinae and Calyptinae, and Muesebeck and Walkley (1951) between Helconinae and Agathidinae. Bouček and Starý (1957), Čapek (1969), and Achterberg (1976) placed it in Helconinae. Tobias (1965), Shenefelt (1969), and Mason (1974) placed it in Euphorinae, and finally Marsh (1979) in Blacinae.

Most recent authors place *Blacus* in the tribe Centistini of the subfamily Euphorinae (*Pygostolus*, *Centistes*, *Syrrhizus*, *Allurus*). The tribe is rather homogenous by its host relations (Coleoptera), biology, (parasites of the adults) as well as by its larval taxonomy (Čapek 1970). Their females are characterized by having a down curved strong ovipositor well adapted for oviposition into hardly sclerotized coleopterous adults. In all these characters *Blacus* differs from Centistini and thus its placement in the Euphorinae is unjustified. On the contrary, *Blacus* exhibits most of the characters of the tribe Brachistini (sensu Mason 1974) of the subfamily Helconinae.

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